An Overview of Green Education Materials Available for Chemical Engineers

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An Overview of Green Education Materials Available for Chemical Engineers

- Pedagogical needs
- Course modules
- Internet sites
- Texts
- Goals of EPA's Green Engineering curriculum development effort
- Overview of materials to be presented in this workshop

An Overview of Green Education Materials Available for Chemical Engineers: Pedagogical needs

- AIChE program requirements for Environment, Health and Safety content in the curriculum

  (Some institutions will respond by developing a required course; others will incorporate modules into courses such as process design)

- Senior elective courses in Design for Environment, Pollution Prevention, Technology and the Environment….

An Overview of Green Education Materials Available for Chemical Engineers: Course Modules

- AIChE CWRT's ***Homework and Design Problems for Engineering Curricula***
- Other published modules from sources such as ***Chemical Engineering Education*** and ***Pollution Prevention Review***
- National Pollution Prevention Center for Higher Education (University of Michigan)
- NSF Combined Research Curriculum Development

An Overview of Green Education Materials Available for Chemical Engineers: Internet sites

- National Pollution Prevention Center for Higher Education
  - http://www.snre.umich.edu/nppc/
- NSF Combined Research Curriculum Development
  - http://www.nd.edu/~enviro/
- Pollution Prevention Workshop
  - http://www.p2workshop.org/

An Overview of Green Education Materials Available for Chemical Engineers: Texts

- ***Pollution Prevention for Chemical Processes***
- ***Pollution Prevention through Process Integration***
- ***Industrial Pollution Prevention Handbook***
- ***Pollution Prevention: Methodology, Technologies, and Practices***
- ***Numerous sources of case studies, and material on related topics such as life cycle assessment, process safety, risk assessment***

Critical needs for Green Engineering Curricular materials

- Many materials have become outdated in this rapidly moving area
- Many recent developments (e.g., Total cost accounting methods, environmental performance metrics, design heuristics)
- Many current case histories lack quantitative detail
- Lack of software tools

Goals of EPA's Green Engineering curriculum development effort

- Develop course materials that could be used to fulfill ABET/AIChE requirements on environment, health and ***(safety)***

  This implies the development of modules that could be used in a variety of courses

- Develop materials suitable for an elective course on Design for Environment, Pollution Prevention, Technology and the Environment….

  This implies the development of a text book

- Make environmental assessment software commonly used at EPA available for classroom use

Overview of materials to be presented in this workshop

- Modules extracted from textbook ***Pollution prevention and environmental risk reduction for chemical processes***
- Modules and material in the text cover two major categories of topics:

  Environmental assessment

  Design improvements

Pollution prevention and environmental risk reduction for chemical processes

- Three major sections

  Part I: Chemical Engineer's guide to environmental issues and regulations

  Part II: Environmental Risk Reduction for Chemical Processes

  Part III: Moving Beyond the Plant Boundary

Pollution prevention and environmental risk reduction for chemical processes

Part I: Chemical Engineer's guide to environmental issues and regulations

Chapter 1: An Introduction to Environmental Issues

Chapter 2: Environmental Risk

Chapter 3: Environmental Regulations: From end of pipe to pollution prevention

Chapter 4: The Roles and Responsibilities of Chemical Engineers

Pollution prevention and environmental risk reduction for chemical processes

Part II: Environmental Risk Reduction for Chemical Processes

Chapter 5: Evaluating Environmental Risks

Chapter 6: Evaluating Environmental Releases and Exposures

Chapter 7: Green Chemistry

Chapter 8: Pollution Prevention in Process Synthesis

Chapter 9: Unit Operations and Pollution Prevention

Chapter 10: Flowsheet Analysis for Pollution Prevention

Chapter 11: Evaluating the Environmental Performance of a Flowsheet

Chapter 12: Evaluating Environmental Costs and Benefits

Pollution prevention and environmental risk reduction for chemical processes

Part III: Moving Beyond the Plant Boundary

Chapter 13: Life Cycle Assessment

Chapter 14: Industrial Ecology

Overview of materials to be presented in this workshop: Modules

- Module 1: Screening chemicals based on environmental fate (Chapter 5)
- Module 2: Screening chemicals and processes based on emissions and risks (Chapters 5 and 6)
- Module 3: Assessing the environmental performance of flowsheets (Chapter 11)
- Module 4: Improving the environmental performance of unit operations and flowsheets (Chapters 9 and 10)
- Module 5: Assessing the economic performance of environmental improvements (Chapter 12)
- Module 6: Life Cycle Assessment (Chapter 13)

Overview of materials to be presented in this workshop: Structure of module presentations

- Educational goals and topics covered in the module
- Potential uses of the module in chemical engineering courses
- Student handouts
- Instructor materials
- Software
- Case studies